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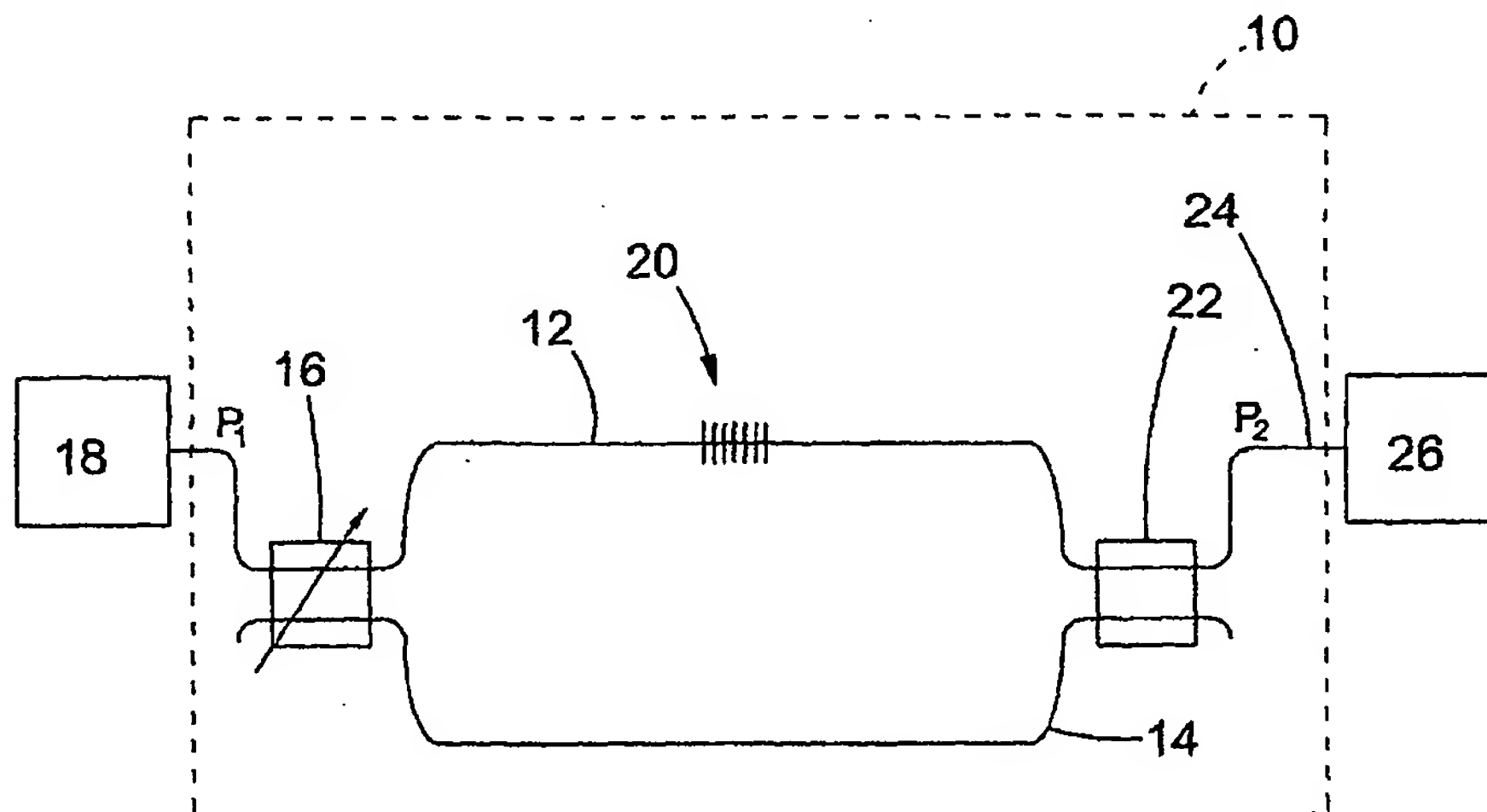
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[Continued on next page]

(54) Title: APPARATUS FOR EQUALISING A SPECTRUM OF A BROADBAND LIGHT SOURCE



(57) Abstract: The invention relates to an apparatus suitable for equalising a spectrum of a broadband light source comprising a first optical path and a second optical path; an optical splatter being connectable to an optical power source, for directing at least part of optical power from the optical power source to each of the first and second optical paths; an optical filter provided in the first optical path for filtering the optical signal propagating there through; and an optical combiner for combining at least part of the optical signals from each of the first and second paths into an output channel. Preferably, the optical splitter is tuneable to direct at least part of the optical power from the optical source to each of the first and second paths, in varying proportions.

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# INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER  
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## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2002/191274 A1 (ONO HIROAKI ET AL) 19 December 2002 (2002-12-19)	1,2,8
Y	paragraphs '0069!-'0074!; figures 6-10	1,2,6-8 5,9,10
X		
Y	TACHIBANA M ET AL: "ERBIUM-DOPED FIBER AMPLIFIER WITH FLATTENED GAIN SPECTRUM" IEEE PHOTONICS TECHNOLOGY LETTERS, IEEE INC. NEW YORK, US, vol. 3, no. 2, 1 February 1991 (1991-02-01), pages 118-120, XP000203005 ISSN: 1041-1135 cited in the application the whole document	1,2,6-8
A		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 473 540 B1 (AUGUSTSSON TORSTEN) 29 October 2002 (2002-10-29) column 1, line 10 - line 35 column 2, line 23 -column 4, line 27; figures 1,2	1,3-5
X	--- NARAYANAN C ET AL: "Silica waveguide (SiWG)-based dynamic gain equalizing filter (DGEF)" PROCEEDINGS OF THE SPIE - THE INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING SPIE-INT. SOC. OPT. ENG USA, vol. 4870, 29 July 2002 (2002-07-29), pages 84-88, XP002296133 ISSN: 0277-786X the whole document	1,3,4,9, 10
X	--- DOERR C R ET AL: "AN AUTOMATIC 40-WAVELENGTH CHANNELIZED EQUALIZER" IEEE PHOTONICS TECHNOLOGY LETTERS, IEEE INC. NEW YORK, US, vol. 12, no. 9, September 2000 (2000-09), pages 1195-1197, XP000968639 ISSN: 1041-1135 the whole document, left-hand column	1,5,7-10
X	--- DOERR C R ET AL: "DYNAMIC WAVELENGTH EQUALIZER IN SILICA USING THE SINGLE-FILTERED- ARM INTERFEROMETER" IEEE PHOTONICS TECHNOLOGY LETTERS, IEEE INC. NEW YORK, US, vol. 11, no. 5, May 1999 (1999-05), pages 581-583, XP000830420 ISSN: 1041-1135	1,7-10
X	page 582, right-hand column, paragraph 3 -page 583, right-hand column, paragraph 2; figures 1,4	5
X	--- EP 0 903 616 A (LUCENT TECHNOLOGIES INC) 24 March 1999 (1999-03-24)	1,5,7,8
X	paragraphs '0009!, '0013!, '0018!; figure 1	9,10
P,X	--- SWART P L ET AL: "Long-period grating filter with tunable attenuation for spectral equalization of erbium-doped fiber broadband light sources" OPTICAL ENGINEERING SPIE USA, vol. 43, no. 2, 25 September 2003 (2003-09-25), pages 280-281, XP002296134 ISSN: 0091-3286 the whole document	1,2,5-10
	--- -/--	

# INTERNATIONAL SEARCH REPORT

International Application No  
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Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/041433 A1 (TERAHARA TAKAFUMI) 11 April 2002 (2002-04-11) paragraphs '0069!-'0077!,'0137!-'0140!; figures 6,26,27	1,2,5, 8-10
A	OFFREIN B J ET AL: "ADAPTIVE GAIN EQUALIZER IN HIGH-INDEX-CONTRAST SION TECHNOLOGY" IEEE PHOTONICS TECHNOLOGY LETTERS, IEEE INC. NEW YORK, US, vol. 12, no. 5, May 2000 (2000-05), pages 504-506, XP000950312 ISSN: 1041-1135 page 504, left-hand column, paragraph 2 -right-hand column, paragraph 1 page 505, left-hand column, paragraphs 1-4; figures 1,2,4	2

# INTERNATIONAL SEARCH REPORT

Int. Application No  
PCT/JP2004/050947

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002191274	A1	19-12-2002	JP 2002372696 A 26-12-2002
			JP 2003084254 A 19-03-2003
			JP 2003066395 A 05-03-2003
US 6473540	B1	29-10-2002	SE 514069 C2 18-12-2000
			AU 4632200 A 17-11-2000
			CA 2370757 A1 09-11-2000
			CN 1349692 T 15-05-2002
			EP 1179238 A1 13-02-2002
			JP 2002543477 T 17-12-2002
			WO 0067407 A1 09-11-2000
			SE 9901559 A 31-10-2000
			TW 468313 B 11-12-2001
EP 0903616	A	24-03-1999	US 5953467 A 14-09-1999
			DE 69808867 D1 28-11-2002
			DE 69808867 T2 18-06-2003
			EP 0903616 A2 24-03-1999
			JP 11160742 A 18-06-1999
US 2002041433	A1	11-04-2002	JP 11224967 A 17-08-1999
			US 6381064 B1 30-04-2002
			US 2003123135 A1 03-07-2003
			US 2004136054 A1 15-07-2004
			FR 2774482 A1 06-08-1999
			FR 2774483 A1 06-08-1999
			FR 2774532 A1 06-08-1999
			US 6219176 B1 17-04-2001